Claims

[c1] 1. A solid oxide fuel cell comprising:
a cathode;
an electrolyte layer adjacent to the cathode; and
an anode adjacent to the electrolyte layer, the anode comprising:
a support structure defining at least a portion of an anode flow channel, the anode flow channel having an anode flow channel entrance for the introduction of fuel to the solid oxide fuel cell and an anode flow channel exit; and
a catalyst that promotes reforming dispersed within or upon the support structure such that the catalyst has a first concentration at a first position and a second concentration at a second position, wherein the first position is closer to the entrance than the second position and the first concentration is lower than the second concentration.

[c2] 2. The solid oxide fuel cell of claim 1 wherein catalyst concentration monotonically increases as distance from the anode flow channel entrance increases for positions between the first position and the second position.

[c3] 3. The solid oxide fuel cell of claim 2 wherein catalyst concentration increases linearly between the first and second position as distance from the anode flow channel entrance increases.

[c4] 4. The solid oxide fuel cell of claim 1 wherein catalyst concentration increases stepwise between the first and second position as distance from the anode flow channel entrance increases.

[c5] 5. The solid oxide fuel cell of claim 1 wherein the catalyst is present in an amount from about 1% to about 50% of the total weight of the anode.

[c6] 6. The solid oxide fuel cell of claim 1 wherein the anode, cathode, and electrolyte layer are arranged in substantially parallel sheets.

[c7] 7. The solid oxide fuel cell of claim 6 further comprising one or more additional anode flow channels.

[c8] 8. The solid oxide fuel cell of claim 6 wherein the cathode defines at least a portion of a cathode flow channel, the cathode flow channel having a cathode flow channel entrance for the introduction of an oxidizing component into the cathode flow channel and a cathode flow channel exit.

[c9] 9. The solid oxide fuel cell of claim 8 wherein the cathode flow channel is adapted to allow flow of the oxidizing component in a direction opposite to the flow of the fuel in the anode flow channel.

[c10] 10. The solid oxide fuel cell of claim 1 wherein the anode, cathode, and electrolyte layer are arranged concentrically.

[c11] 11. The solid oxide fuel cell of claim 1 wherein the catalyst comprises nickel or a nickel-containing compound.

[c12] 12. An automobile at least partially powered by the solid oxide fuel cell of claim 1.

[c13] 13. A solid oxide fuel cell comprising:
a cathode having one or more cathode flow channels;
an electrolyte layer adjacent to the cathode; and
an anode adjacent to the electrolyte layer, the anode comprising one or more anode flow channels each anode flow channel having an anode flow channel entrance and a catalyst that promotes reforming dispersed within or upon a surface of the one or more anode flow channels such that the catalyst has a first concentration at a first position and a second concentration at a second position, wherein the first position is closer to the anode flow channel entrance than the second position and the first

concentration is lower than the second concentration.

[c14] 14. The solid oxide fuel cell of claim 13 wherein catalyst concentration monotonically increases as distance from the anode flow channel entrance increases for positions between the first position and the second position.

[c15] 15. The solid oxide fuel cell of claim 14 wherein catalyst concentration increases linearly between the first and second position as distance from the anode flow channel entrance increases.

[c16] 16. The solid oxide fuel cell of claim 1 wherein the catalyst comprises nickel or a nickel-containing compound.

[c17] 17. A method of controlling kinetic rates for internal reforming of fuel in solid oxide fuel cells having a cathode having a cathode flow channel and a cathode flow channel entrance and an anode having an anode flow channel and an anode flow channel entrance, the method comprising:

flowing fuel through the anode flow channel such that the fuel contacts a surface of the anode flow channel, the surface of the anode flow channel having a catalyst that promotes reforming dispersed within or upon the surface with a concentration profile such that the rate of the reforming reaction increase monotonically with distance

from the anode flow channel entrance.

[c18] 18. The method of claim 17 wherein catalyst concentration monotonically increases as distance from the anode flow channel entrance increases for positions between the first position and the second position.

[c19] 19. The method of claim 18 wherein catalyst concentration increases linearly between the first and second position as distance from the anode flow channel entrance increases.

[c20] 20. The method of claim 17 wherein catalyst concentration increases stepwise between the first and second position as distance from the anode flow channel entrance increases.

[c21] 21. The method of claim 17 wherein the catalyst is present in an amount from about 1% to about 50% of the total weight of the anode.

[c22] 22. The method of claim 17 further comprising flowing an oxidizing component through the cathode flow channel.

[c23] 23. The method of claim 22 wherein the oxidizing component is flowed through the cathode flow channel in an opposite direction than the fuel is flowed through the

anode flow channel.

[c24] 24. The method of claim 17 wherein the catalyst comprises nickel or a nickel-containing compound.